Wind Energy and Power Grids

The power produced by wind farms varies due to the natural fluctuations in wind speed. With increasing contributions of wind energy within the power supply systems, challenges regarding its integration arise, for instance:

- Managing wind power production,
- Increasing grid capacity, and
- Provision of balancing power.

It is generally expected that an increasing need for balancing power will result from adding large offshore wind farms in Germany. To neutralise this effect, it is necessary to adjust the operation of the grid as a whole to the requirements of a modern mix of energy sources.

In order to optimise network management – and thus the overall economic efficiency of energy supply – it is recommended to feed wind energy into the grid in a controlled manner (»dispatching«). This would:

- Enable scheduling of wind electricity production (bringing increased reliability of wind energy generation and allowing for intermediate storage of excess energy),
- Minimise the use of balancing power (minimising the consumption of fossil fuels), and
- Bring wind power closer to the taditional energy markets.

The Project

Companies and organisations with a variety of backgrounds are cooperating in the research and development project HyWindBalance: scientific bodies, engineering companies and consultancies in the fields of wind energy, hydrogen technology and IT as well as financial service providers and utilities. The project is co-funded by the federal state of Lower Saxony, the European Regional Development Fund, and EWE AG.

This consortium will develop, analyse, and test a system which combines wind power with the easily stored energy vector hydrogen. Some of the main elements of such facilities are electrolysers, hydrogen storage, fuel cells, and sophisticated control units that optimise the performance of the system by means of wind power prediction and load forecasting.

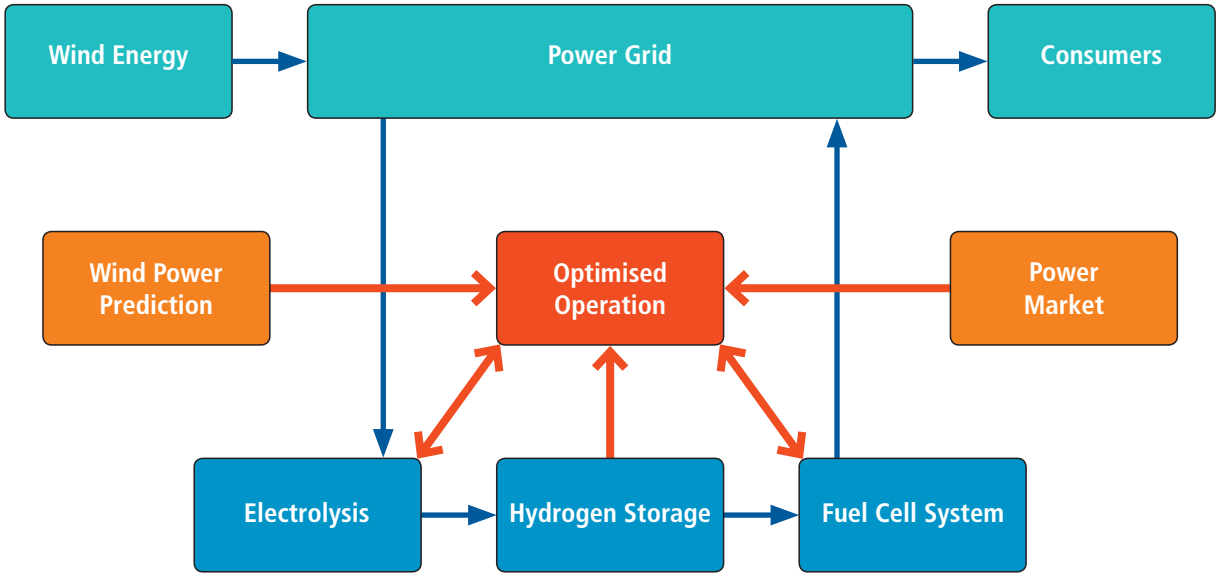
The main aim of this joint venture is to develop a wind hydrogen system that, in its function as a »virtual power plant«, establishes the following options for wind energy:

- Scheduled generation,
- Reduction of need for balancing power from conventional power plants (secondary balancing power),
- Sale of wind-based electricity as balancing power on the spot market.

It is noteworthy that wind-hydrogen systems provide balancing power free of carbon dioxide.

In the medium term, it will be possible to sell hydrogen from surplus wind energy to markets other than the electricity sector, for example as fuel for road vehicles. Such diversification of wind energy would relieve the electricity market from excess production.

Wind-Hydrogen System for Providing Balancing Power



Expected Results

The following main results are expected:

- A concept for wind-hydrogen systems both for the provision of balancing power and for the introduction of scheduled generation from wind farms,
- Optimised operating strategies for such systems under different meteorological, technical, and market conditions which incorporate wind power prediction and load forecasting,
- Simulation software that can map out the behaviour of system components and plant management,
- Experiences with a research unit comprised of electrolyser, hydrogen storage, fuel cell, and operating control,
- Technical and economical assessment of the feasibility of this technology at a large scale, and
- A training module for teaching technology and state-of-the-art of fuel cells, energy storage, and balancing power.

Research and Development Project

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